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RECENT FOREIGN SURVEYS UNDER THE DIRECTION OF THE U. S. HYDROGRAPHIC OFFICE.

BY

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The principal geographical work under the direction of the Hydrographic Office during the last year was carried on in Mexico, Guatemala, and Honduras. The continuation of the survey of the Mexican coast was executed in compliance with an act of Congress, for the improvement of the means for the safe navigation of that coast. The surveys of Honduras Bay, Santo Tomas Bay, Port Livingston, Hospital Bight, and Port Cortés, in Guatemala and Honduras, were undertaken by the Navy Department in the winter of 1895 and 1896 at the request of the government of Guatemala, and the urgent solicitation of those representing the industries of that region.

THE SURVEY OF THE WEST COAST OF MEXICO.

During the interval from 1885 to 1895, the survey of the west coast of Mexico has progressed from the boundary line between the United States and Mexico, at San Diego, California, to Entrada Point, the northern entrance to Magdalena Bay, a distance, measured parallel to the general trend of the coast, of 550 geographical miles. The survey has consisted throughout of a main, and a secondary or shore triangulation, conducted from accurately measured base-lines. In connection with the triangulation, the coast line and topography have been delineated. The geographical positions of selected points in the harbors and anchorages and, with special accuracy, at the beginning and end of each season's work, have been established by astronomical observations with a portable transit and by the transportation of time by nine chronometers from the secondary meridian of San Diego. At or near these observation spots, the magnetic declination, dip, and intensity have been determined by means of a portable Kew magnetometer and a Dover dip circle.

As the survey was undertaken solely for the production of charts for the use of mariners, special attention was given to the development of the bottom of the sea between the coast and the 100-fathom line, the object being to set forth on the charts, by the fullness and sequence of the soundings, the depth of water at every step. It was the aim to include all information of a nature to aid the navigator in navigating his ship, such as the appearance of the shore, whether high cliff, low rock, flat beach, marsh, or mud bank; the general elevation; whether it is barren or cultivated; convenient landing places; the materials of the beach, whether sand, gravel, shells, shingle, or stones; the condition of the shore with respect to surf and breakers; the places where water, wood, or coal can be procured; and the mountains and hills which can be seen from the offing, with their heights expressed in figures and by contour lines, and with whatever conspicuous objects stand upon their sea faces.

During the season of 1895 and 1896 the officers of the U. S. S. *Thetis* extended the survey from Entrada Point to Lobos Point, just below Todos Santos, a distance, reckoned parallel to the coast, of about 120 geographical miles. Their work consists of the surveys of Magdalena, San Lucas, and Santa Maria bays, with adjacent lagoons, and the continuation of the survey of the west coast of Lower California, embracing triangulation, topography, and hydrography within the limits above stated. Near Todos Santos a baseline two miles long was accurately measured.

Tidal observations were made at Man of War Cove, Magdalena Bay, from October 9 to December 10, 1895, every 15 minutes, day and night. The box gauge upon which the heights were measured was well protected, and during the whole period of observation there were no atmospheric changes of sufficient importance to cause any marked irregularity in the tide. The deduced mean interval elapsing between the upper transit of the moon and the time of high water was eight hours and seventeen minutes, and the mean interval between the upper transit of the moon and the time of low water was fourteen hours and three minutes. The greatest rise and fall of the tide was found to be eight feet, the least rise and fall 2/10 of a foot, and the mean rise and fall 3–81/100 feet. The mean length of flood tide (from low water to high water) is six hours and fifteen minutes, and the mean length of ebb tide (from low water to high water) six hours and eight minutes. The corrected establishment of the port is eight hours and twenty minutes.

The brick pier, marking the astronomical observation station at Todos Santos, whose geographical position was determined to be in latitude 23° 27′ 13″.78 and in longitude 110° 14′ 07″.65 west of Greenwich, is situated on the seaward brow of the first ridge to the northward of Todos Santos Valley. About thirty feet east of the pier is a small adobe hut, and about seventy-five yards to the westward, at the foot of the slope, is a larger adobe dwelling. Magnetic observations were also made at this pier which determined the magnetic declination for January, 1896, to be 9° 11'.9 E., the dip 49° 00'.45, the horizontal intensity 0.33082, and the total intensity 0.5043 C. G. S. units.

At the northern extremity of the season's work is the village of Magdalena, now much shrunken in size on account of the decline of the orchilla trade, and deriving whatever of importance it has at the present time from the fact that its magnificent harbor is the only perfectly sheltered port of refuge on the west coast of the peninsula of Lower California. Formerly, some 20 years ago, when the business of gathering and exporting orchilla from Lower California was at its height, Magdalena was a port of considerable commercial activity and importance; and often, it is said, 15 or 20 vessels would then be found at anchor within the bay waiting for their cargoes of orchilla. But of late years, the decadence of that trade has left the town without sufficient commerce to justify its existence; and it is consequently dwindling away. It has at the present time about thirty frame and adobe houses, and about fifty inhabitants. Its scanty supply of water, brackish and scarcely drinkable, is brought from the spring several miles distant. No vegetation is to be seen in the vicinity of the town.

Notwithstanding these disadvantages, it still retains some of the characteristics of a town. Its chief municipal officer is a "Juez," subordinate to, and under the jurisdiction of, the "Presidente," or Mayor, of the inland town of Comondu, which is between fifty and sixty miles distant. There is a post office in the town, from which an overland mail is occasionally sent to La Paz, and thence reaches the interior towns. The Pacific Coast Steamship Company's steamer *St. Paul* touches at Magdalena for a few hours once a month on its northern voyage.

At the southern extremity of the season's work, on the bank of the Todos Santos River, a never-failing stream of water flowing through the fertile valley of the same name, is the village of Todos Santos, situated about two miles inland on the site of the ancient mission of Santa Rosa. Here the 800 people that make up the population, surrounded by well cultivated fields of sugar-cane and by gardens in which are found the cereals and vegetables of the north together with the fruits of the south, live in the enjoyment of a climate which combines the advantages of the temperate and the tropical zones. There is no harbor here, but in moderate weather a good anchorage, which is indicated on the charts, may be found off Lobos Point.

Between Magdalena and Todos Santos the surveyors found a barren, rolling country, not more than 50 to 100 feet above the level of the sea within a distance of four or five miles from the shore, cut by gullies and arroyos, and covered in many parts with cactus and stunted brush. Skirting the sea ridge, which extends along the beach almost uninterruptedly throughout this region with a height from 10 to 30 feet, is the main highway of Lower California, called the Camino Real, leading northward from San José del Cabo, near Cape San Lucas, to the important places of the Peninsula. Between Todos Santos and the region of Magdalena Bay it is never more than a mile from the sea, instead of in the middle of the Peninsula, as generally represented in the maps of the present time.

Within the region surveyed this highway passes through Palmarito, Carisal, Inocentes, Tiputati, Cuñano, Conejo and San Luis, and thence northward to Comondu.

Comondu, situated in the mountains of Lower California, in latitude 26° 04′ and longitude 111° 44′ west of Greenwich, is the chief town and seat of government of a section of Lower California extending from the Gulf of California to the Pacific Ocean and from a point north of Purísima to the neighborhood of Magdalena Bay.

It was founded in 1708 by Jesuit missionaries in a locality some twenty miles north of the present site, which had to be abandoned on account of the scarcity of water. The present town has about 1,000 inhabitants, and, excepting La Paz, it is the largest place in the southern half of Lower California. There are two schools for children, and a church; and some of the houses are built of stone instead of adobe, the usual building material in this country. The church, which is two miles above the town, is carefully built of stone and brick. Its excellent masonry, its arched brick roof, and the few remaining bits of wood carving, reveal the religious care and enthusiasm of the Jesuits, who erected it nearly two centuries ago. Of the parts that the ravages of time have spared for the use of the present generation is a beautiful chime of eight bells brought from Spain. The town is located in the narrow valley of the Comondu, forty miles from Boca de las Animas, on the Pacific Coast, and about the same distance from Loreto, on the Gulf of California. It is thirty miles south of Purísima, and thirty-five miles north of San Javier. With the outer world it is connected by trails passing over the most rugged mountains and tablelands. Over these the mail is brought on muleback from La Paz twice a month. The settlement extends along the valley six or eight miles, three or four miles above and below the town proper. At the upper end of the settlement the valley narrows down to a mere defile and ends abruptly in the side of the lofty table-lands. At this point there are two springs, only a few yards apart, which afford the settlement its supply of cold and warm water respectively.

It seldom rains in Comondu. They look for one or two showers each year, but there are sometimes periods of several years when no rain falls. There is but little variation in the temperature the year round. In the valleys they have no frosts, and hail storms are very exceptional. The prevailing winds are from the north and northwest, although they are not perceptible in the deep cañon of the Comondu. This little valley is described as a veritable paradise. A genial climate and never-failing water supply give rise to a vegetation in a strange contrast to the surrounding barrenness. The bottom of the valley is made up of a rich alluvial deposit in which can be grown everything that flourishes in a temperate or subtropical climate. Oranges, dates, figs, grapes, olives, pomegranates, wheat, rye, barley, sugar-cane, beans, pease, and many garden vegetables are raised. Each year quantities of oranges, dates, figs and raisins are transported across the mountains to the Gulf, and shipped to various points. The chief occupation is agriculture on a small scale, and often not beyond the actual needs of the family. A few cattle are raised.

There are no trades-people in the town. Each family tans its own leather, and most of them make their own shoes. A little light wine is manufactured. Sugar of a coarse quality is made from the sugar-cane. An intoxicating drink called *mescal* is distilled from the roots of a plant growing in the neighborhood.

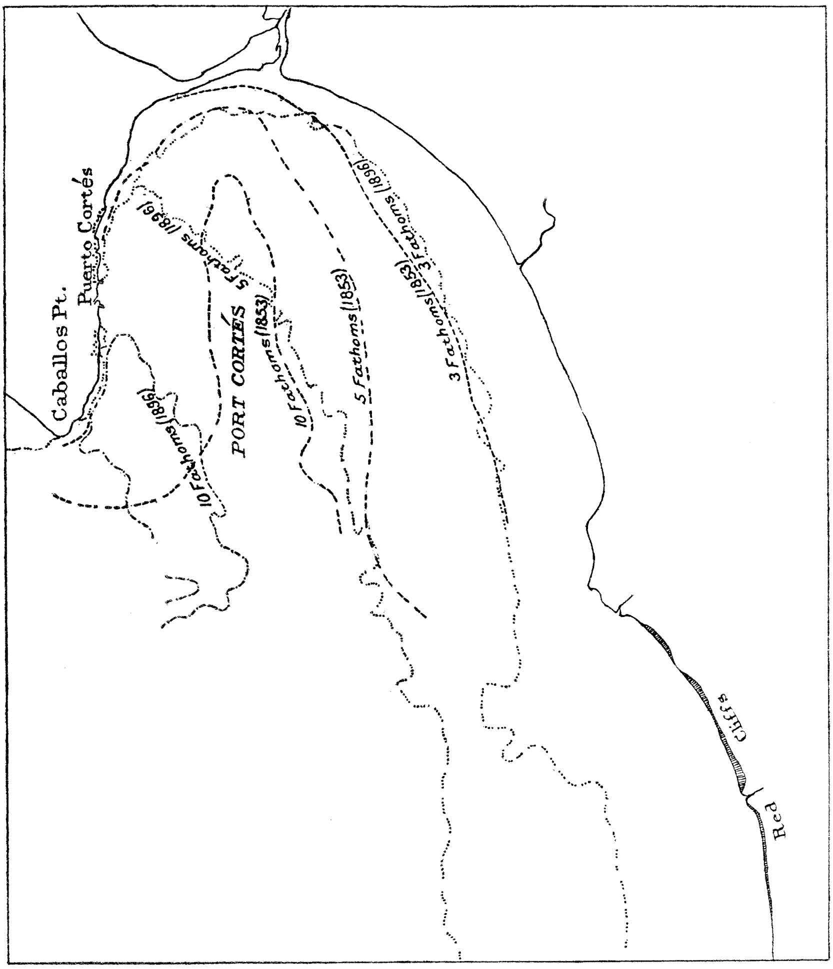
The notable health and longevity of the native inhabitants of the comparatively few small settlements that have grown up wherever, in the midst of this barren land, there are soil and water enough to raise a living, is worthy of remark. At San José de Garcia ranch, situated about 10 miles from the Pacific coast, in latitude 26° 35′, there are 5 families, numbering 59 souls, chiefly proceeding from intermarriage between two families which established a settlement there 130 years ago. The patriarch and chief owner is 73 years of age, and has resided there all his life. About 50 years ago he succeeded his father, who, in turn, had succeeded his father. The mother of this man is also living at the ranch in good health at the age of 93 years, and his uncle died there within late years after spending a lifetime of 115 years upon the same spot.

No serious sickness has visited this settlement since 1840, when there was an epidemic of cholera morbus of short duration.

GUATEMALA AND HONDURAS SURVEYS.

Guatemala and Honduras have advanced in the scale of commercial importance since the survey of the coast of Central America by the British Admiralty between 1833 and 1841. The demands of the regular lines of steamships running from New York and New Orleans to Livingston and Puerto Barrios, the great increase of shipping from the ports of the United States, and the reports of the incompleteness of the former survey and of the finding of uncharted shoals in the approaches to Puerto Barrios in the Gulf of Amatique were sufficient to justify the request for a new survey of the Bay of Honduras, especially as an impression was gaining ground that this magnificent water was silting up at such a rate as to threaten the continued approach to Puerto Barrios. It is difficult to account for the origin of this idea since the Peninsula of Manambique ought to protect the Bar of Honduras from all tidal deposits from the silt of the Motagua River, and there is no other silt-bearing river in this region. An examination of an old English Admiralty chart of 1803 shows the existence at that time of one of the two recently reported shoals in the fairway to Puerto Barrios.

During January and February, 1896, the officers of the U. S. S. *Dolphin* made a detailed survey of the whole of the Bay of Honduras or Gulf of Amatique lying southward of a line joining Cape Three Points with the town of Livingston. The results of this survey are forthcoming in the following designated Hydrographic Office charts: Honduras Bay, scale 2 inches to the nautical mile; Santo Tomas Bay, scale 6 inches to the nautical mile; Port Livingston, scale 8 inches to the nautical mile; and Hospital Bight, scale 4 inches to the nautical mile. From a carefully measured base-line, a triangulation was carried on by theodolite throughout the region bordering the entire Bay. The positions of the soundings were determined by sextant angles measured between the signals which were erected at the triangulation stations. The lines of soundings were spaced 300 feet apart in one direction in Santo Tomas Bay and 600 feet in the other direction at right angles to the first, and in the main Bay 600 feet and 1,200 feet likewise. All shoals were developed in detail. A comparison of the results of this survey with the earlier one shows, when allowances are made for the greater completeness of the later work and for the correction of more than a mile in the geographical positions in all parts of the shore line, that there is a striking agreement and that the contours of the bottom of this body of water have not materially changed since our first knowledge of them was recorded. With a view of determining the geographical position of the starting point of the survey with the greatest accuracy obtainable, the surveyors placed themselves in communication with the Chief of the Guatemalan Boundary Survey at Guatemala, where a longitude of the first order was determined in 1884 by telegraphic time signals from La Libertad, Salvador, in connection with the work of establishing a chain of telegraphic longitudes, by submarine cable connections,



that was carried on by the U. S. Hydrographic Office during the decade following 1874. Telegraphic time signals were transmitted from Guatemala to Puerto Barrios on three successive nights, and provided for the deduction of a satisfactory longitude. The resulting geographical position for the southeast corner-stone of the Comandancia at Puerto Barrios is 15° 43′ 26″ north and 88° 36′ 15″ west of Greenwich.

The tidal observations that were made throughout the period of the survey show that the time of tide is largely influenced by the wind, and that the rise and fall is about 8 inches.

At the completion of the survey of Honduras Bay, the ship moved to Port Cortés, situated 40 miles to the eastward, in Honduras, and about six miles east of Omoa, where the inner harbor has filled up since the survey of 1844. The town of Puerto Cortés, located in the northeastern part of the Port, is the terminus of the Interoceanic Railway of Honduras and a place of considerable commercial importance. The survey, which was carried on with a degree of detail like that described with reference to Honduras Bay, has lately been published at the Hydrographic Office, on a scale of 4 inches to the nautical mile. A comparison of this chart with that constructed from the surveys by Commander Owen, R. N., in 1830, and Lieutenant Jeffers, U. S. N., in 1853, shows that extensive changes have taken place in the contours of the bottom and in the depths of water, especially in the eastern part of the harbor, where large areas have shoaled from 7 down to 4 fathoms. These changes are set forth in the accompanying chart, where the contours of the bottom in 1853 are contrasted with those in 1896. None of these changes, however, affect the port as far as navigation is concerned. It is a fine, extensive harbor capable of accommodating with safety a large amount of shipping at all times except during the prevalence of northers. These storms blow from the west in this locality, or directly into the harbor; and it sometimes happens that, during two or three days, the sea raised by the wind is so heavy that vessels are compelled to leave the harbor and put to sea for safety. A notable result of the recent survey is the development of an error of more than two miles in the latitude which has heretofore been accepted for Puerto Cortés.